WEST Search History

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DATE: Tuesday, October 05, 2004

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	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
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☐	L1	((flat substrate) or (thin articles)) and processing	2970

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Search Results - Record(s) 1 through 9 of 9 returned.

1. Document ID: US 20040168707 A1

Using default format because multiple data bases are involved.

L4: Entry 1 of 9 File: PGPB Sep 2, 2004

PGPUB-DOCUMENT-NUMBER: 20040168707
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040168707 A1

TITLE: Apparatus and methods for reducing damage to substrates during megasonic cleaning processes

PUBLICATION-DATE: September 2, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	
Olesen, Michael B.	Yorba Linda	CA	US	
Wu, Yi	Irvine	CA	US	

US-CL-CURRENT: 134/1.3; 134/137, 134/184, 134/32, 134/33, 134/34

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D

2. Document ID: US 20040079768 A1

L4: Entry 2 of 9 File: PGPB Apr 29, 2004

PGPUB-DOCUMENT-NUMBER: 20040079768
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040079768 A1

TITLE: Device manufacturing apparatus and method, and driving method for device manufacturing apparatus

PUBLICATION-DATE: April 29, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Kiguchi, Hiroshi	Suwa-shi		JP	

US-CL-CURRENT: 222/420; 222/1

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ABSTRACT:

[Object] To provide a device manufacturing apparatus in which a device can be precisely manufactured by stably ejecting a predetermined amount of droplets when the device is manufactured using a droplet ejecting device.

[Solving Means] A pressure generation chamber 3 has a Helmholtz resonance frequency of a period TH. A driving signal includes a first signal element to cause the pressure generation chamber 3 to expand, a second signal element to cause the expanded pressure generation chamber 3 to contract, and a third signal element to cause the pressure generation chamber 3 to expand to its original state, which is held before the first signal element is output, after ejection of a droplet. The time which elapses between the beginning of output of the first signal element and the beginning of output of the second signal element, and the time which elapses between the beginning of output of the second signal element and the beginning of output of the third signal element are set to be substantially equivalent to the period TH. The sum of the amplitude of the first signal element and that of the third signal element is set to be substantially equivalent to the amplitude of the second signal element.

☐ 3. Document ID: US 20030141784 A1

L4: Entry 3 of 9 File: PGPB Jul 31, 2003

PGPUB-DOCUMENT-NUMBER: 20030141784
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030141784 A1

TITLE: Megasonic probe energy director

PUBLICATION-DATE: July 31, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	

US-CL-CURRENT: 310/328

ABSTRACT:

A megasonic cleaning apparatus configured to provide effective cleaning of a substrate without causing damage to the substrate is provided. The apparatus includes a megasonic probe, a transducer configured to energize the probe, and a heat transfer element disposed between the transducer and the probe. The heat transfer element may be configured to direct the sonic energy from the transducer toward specific areas of the probe so as to reduce the effect of normal-incident waves relative to shallow-angle waves. Alternatively, a rear end face of the probe may be configured for this purpose. Another embodiment provides a coupler disposed between the heat transfer element and the rear end face of the probe for directing the sonic energy from the transducer toward specific areas of the probe.

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☐ 4. Document ID: US 20030024547 A1

L4: Entry 4 of 9 File: PGPB Feb 6, 2003

PGPUB-DOCUMENT-NUMBER: 20030024547
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030024547 A1

TITLE: Megasonic probe energy attenuator

PUBLICATION-DATE: February 6, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	
Olesen, Michael B.	Yorba Linda	CA	US	
Wu, Yi	Irvine	CA	US	

US-CL-CURRENT: 134/1; 134/1.3, 134/902, 310/328, 310/334, 310/346, 310/367, 310/369

ABSTRACT:

The present invention provides a megasonic cleaning apparatus configured to provide effective cleaning of a substrate without causing damage to the substrate. The apparatus includes a probe having one of a variety of cross-sections configured to decrease the ratio of normal-incident waves to shallow-angle waves. One such cross-section includes a channel running along a portion of the lower edge of the probe. Another cross-section includes a narrow lower edge of the probe. Another cross-section is elliptical. Another cross-section includes transverse bores originating in the lower edge of the probe. As an alternative to, or in addition to, providing a probe having a cross-section other than circular, the present invention may also provide a probe having a roughened lower surface.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 5. Document ID: US 20030010357 A1

L4: Entry 5 of 9 File: PGPB Jan 16, 2003

PGPUB-DOCUMENT-NUMBER: 20030010357
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030010357 A1

TITLE: Wafer cleaning

PUBLICATION-DATE: January 16, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47

h e b b g e e e f e ef b e

Bran, Mario E. Garden Grove CA US

US-CL-CURRENT: 134/1.3; 134/148, 134/151, 134/153, 134/198, 134/34, 134/902

ABSTRACT:

Semiconductor wafers are cleaned using megasonic energy to agitate cleaning fluid applied to the wafer. A source of energy vibrates an elongated probe which transmits the acoustic energy into the fluid. The probe has a solid cleaning rod and a flared or stepped rear base. In one form, the probe is made of one piece, and in another, the rod fits into a socket in the base. This enables a rod to be made of material which is compatible with the cleaning solution, while the base may be of a different material. A heat transfer member acoustically coupled to the probe base and to a transducer conducts heat away from the transducer. A housing for the heat transfer member and the transducer supports those components and provides means for conducting coolant through the housing to control the temperature of the transducer. In another arrangement, an end of the housing is coupled between the transducer and the probe. In one arrangement, fluid is sprayed onto both sides of a wafer while a probe is positioned close to an upper side. In another arrangement, a short probe is positioned with its end face close to the surface of a wafer, and the probe is moved over the wafer as it rotates. The probe may also be positioned through a central hole in a plurality of discs to clean a group of such elements at one time.

6. Document ID: US 6681782 B2

L4: Entry 6 of 9 File: USPT Jan 27, 2004

US-PAT-NO: 6681782
DOCUMENT-IDENTIFIER: US 6681782 B2
**** See image for Certificate of Correction ****

TITLE: Wafer cleaning

DATE-ISSUED: January 27, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bran; Mario E.	Garden Grove	CA		

US-CL-CURRENT: 134/148; 134/1.3, 134/147, 134/151, 134/153, 134/184, 134/199, 134/25.4, 134/902

ABSTRACT:

Semiconductor wafers are cleaned using megasonic energy to agitate cleaning fluid applied to the wafer. A source of energy vibrates an elongated probe which transmits the acoustic energy into the fluid. The probe has a solid cleaning rod and a flared or stepped rear base. In one form, the probe is made of one piece, and in another, the rod fits into a socket in the base. This enables a rod to be made of material which is compatible with the cleaning solution, while the base may be of a different material. A heat transfer member acoustically coupled to the probe

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base and to a transducer conducts heat away from the transducer. A housing for the heat transfer member and the transducer supports those components and provides means for conducting coolant through the housing to control the temperature of the transducer. In another arrangement, an end of the housing is coupled between the transducer and the probe. In one arrangement, fluid is sprayed onto both sides of a wafer while a probe is positioned close to an upper side. In another arrangement, a short probe is positioned with its end face close to the surface of a wafer, and the probe is moved over the wafer as it rotates. The probe may also be positioned through a central hole in a plurality of discs to clean a group of such elements at one time.

12 Claims, 17 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 11

7. Document ID: US 6679272 B2

L4: Entry 7 of 9 File: USPT Jan 20, 2004

US-PAT-NO: 6679272
DOCUMENT-IDENTIFIER: US 6679272 B2

TITLE: Megasonic probe energy attenuator

DATE-ISSUED: January 20, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bran; Mario E.	Garden Grove	CA		
Olesen; Michael B.	Yorba Linda	CA		
Wu; Yi	Irvine	CA		

US-CL-CURRENT: 134/1.3; 134/1, 134/137, 134/148, 134/151, 134/153, 134/184, 134/198, 134/34, 134/902, 310/311, 310/320, 310/367, 310/368, 310/369, 310/370, 34/255

ABSTRACT:

The present invention provides a megasonic cleaning apparatus configured to provide effective cleaning of a substrate without causing damage to the substrate. The apparatus includes a probe having one of a variety of cross-sections configured to decrease the ratio of normal-incident waves to shallow-angle waves. One such cross-section includes a channel running along a portion of the lower edge of the probe. Another cross-section includes a narrow lower edge of the probe. Another cross-section is elliptical. Another cross-section includes transverse bores originating in the lower edge of the probe. As an alternative to, or in addition to, providing a probe having a cross-section other than circular, the present invention may also provide a probe having a roughened lower surface.

14 Claims, 15 Drawing figures
Exemplary Claim Number: 14
Number of Drawing Sheets: 7

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Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 8. Document ID: US 5989190 A

L4: Entry 8 of 9 File: USPT Nov 23, 1999

US-PAT-NO: 5989190
DOCUMENT-IDENTIFIER: US 5989190 A
**** See image for Certificate of Correction ****

TITLE: Passive sensor system using ultrasonic energy

DATE-ISSUED: November 23, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Kaplan; Shay	Givat Elah			IL

US-CL-CURRENT: 600/438

ABSTRACT:

A passive sensor system utilizing ultrasonic energy is disclosed. The passive sensor system includes at least one ultrasonically vibratable sensor and an ultrasonic activation and detection system. The sensor has at least one vibration frequency which is a function of a physical variable to be sensed. The ultrasonic activation and detection system excites the sensor and detects the vibration frequency from which it determines a value of the physical variable. The sensor includes a substrate having at least one cavity therein, and a vibratable membrane overlying the cavity. Another preferred embodiment of the sensor is a compensated sensor pair including a first sensor whose vibration frequency is responsive to the physical variable to be sensed, and a second sensor whose vibration frequency is non-responsive to the physical variable to be sensed. The second sensor provides a reference vibration frequency for compensating for the effect of other physical variables on the vibration frequency of the first sensor. Another preferred embodiment of the compensated sensor pair includes a second sensor which has a different response characteristic than that of the first sensor to the physical variable to be sensed. In still another preferred embodiment of the compensated sensor of the present invention each of the pair of sensors has multiple vibratable membranes overlying multiple cavities.

11 Claims, 17 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 6

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 9. Document ID: US 3542453 A

L4: Entry 9 of 9 File: USOC Nov 24, 1970

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US-PAT-NO: 3542453
DOCUMENT-IDENTIFIER: US 3542453 A

TITLE: GRATING DEVICE COMPOSED OF ELONGATED LAYERS

DATE-ISSUED: November 24, 1970

INVENTOR-NAME: KANTOR FREDERICK W

US-CL-CURRENT: 359/565; 216/24, 428/635

Term	Documents
TRANSMITTING	932523
TRANSMITTINGS	15
(3 AND TRANSMITTING).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	9
(L3 AND TRANSMITTING).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	9

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L1: Entry 1 of 1 File: JPAB Jun 4, 1979

PUB-NO: JP354069260A
DOCUMENT-IDENTIFIER: JP 54069260 A
TITLE: ULTRASONIC ROTARY CLEANING APPARATUS

PUBN-DATE: June 4, 1979

INVENTOR-INFORMATION:

NAME	COUNTRY
OHIRA, TOKUAKI	

US-CL-CURRENT: 134/139
INT-CL (IPC): B08B 3/12

ABSTRACT:

PURPOSE: To provide an ultrasonic rotary cleaning apparatus, in which cleaning liquid is ejected onto an article to be cleaned, in the manner that said article is rotated by the impact force of the cleaning liquid, whereby it is enabled to clean the article cleanly in a short while if shape of the article is rather complicated.

CONSTITUTION: An article 3 to be cleaned is supported in cleaning liquid 1 by use of support shaft 2. Ultrasonic vibration is applied to the cleaning liquid 1 by means of vibtator 6. In the above arrangement, cleaning liquid 1 is drawn by pump 8, delivered into condiut 10 through filter 9, and ejected onto article 3 from nozzles 4, 4'. As a result, article 3 is made to rotate by the hydraulic pressure of the cleaning liquid 1. At the same time, turbulence is generated in cleaning liquid 1, so that hydraulic pressure is applied to article 3 from various drections. With such an arrangement, it is enabled to simplify the structure of ultrasonic rotary cleaning apparatus and to reduce power consumption of the same.

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L4: Entry 3 of 9 File: PGPB Jul 31, 2003

PGPUB-DOCUMENT-NUMBER: 20030141784
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030141784 A1

TITLE: Megasonic probe energy director

PUBLICATION-DATE: July 31, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	

APPL-NO: 10/ 059682 [PALM]
DATE FILED: January 29, 2002

INT-CL: [07] H01 L 41/08

US-CL-PUBLISHED: 310/328
US-CL-CURRENT: 310/328

REPRESENTATIVE-FIGURES: 7A

ABSTRACT:

A megasonic cleaning apparatus configured to provide effective cleaning of a substrate without causing damage to the substrate is provided. The apparatus includes a megasonic probe, a transducer configured to energize the probe, and a heat transfer element disposed between the transducer and the probe. The heat transfer element may be configured to direct the sonic energy from the transducer toward specific areas of the probe so as to reduce the effect of normal-incident waves relative to shallow-angle waves. Alternatively, a rear end face of the probe may be configured for this purpose. Another embodiment provides a coupler disposed between the heat transfer element and the rear end face of the probe for directing the sonic energy from the transducer toward specific areas of the probe.

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L4: Entry 3 of 9 File: PGPB Jul 31, 2003

PGPUB-DOCUMENT-NUMBER: 20030141784
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030141784 A1

TITLE: Megasonic probe energy director

PUBLICATION-DATE: July 31, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	

US-CL-CURRENT: 310/328

CLAIMS:

What is claimed is:

1. An assembly for cleaning a thin, flat substrate comprising: a transmitter to be positioned above a substantially flat surface of the substrate so that when liquid is applied to a small gap between the transmitter and the substrate, a meniscus of liquid is formed between the transmitter and the substrate; and a transducer coupled to the transmitter in a manner to create a transmission path for transmitting megasonic vibration from the transducer through the transmitter to the substrate, the transducer being coupled to the transmitter in a manner to attenuate the energy transmitted to a lowermost portion of the transmitter to prevent damage to delicate devices on the substrate that are substantially directly beneath the lowermost portion, while portions of the transmitter adjacent the lowermost portion are not so attenuated.

2. The assembly of claim 1, including a gap in the transmission path, the gap being aligned with the lowermost portion of the transmitter to attenuate the megasonic energy transmitted to the lowermost portion.

3. The assembly of claim 1, including a barrier to the transmission of megasonic energy in the transmission path that attenuates the energy transmitted to said lowermost portion.

4. The assembly of claim 1, wherein said lowermost portion has an elongated configuration forming an edge uniformly spaced from the substrate.

5. The assembly of claim 1, including a support for the substrate; and a source of liquid to be applied to the gap between the substrate and the transmitter.

6. The assembly of claim 5, wherein said source of liquid includes a dispenser for dispensing liquid into said gap.

7. The assembly of claim 1, wherein said transmitter includes a rear face which is

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coupled to said transducer, and the rear face is configured so that megasonic energy is not transmitted from the transducer to the transmitter in a portion of said end face so as to attenuate the energy transmitted to said lowermost edge.

8. The assembly of claim 7, wherein said rear face is generally circular, and said portion comprises a wedge-shaped recess in said end face.

9. The assembly of claim 1, wherein said transmitter comprises an elongated rod having a generally circular end face, said transducer is coupled to said end face to create said transmission path, said path including a portion in which the transmission of energy from the transducer to the transmitter is attenuated in a manner to produce attenuation of the megasonic energy at said lowermost edge.

10. The assembly of claim 1, including a heat transfer element positioned between the transducer and the transmitter and forming a portion of said transmission path, said element being configured to attenuate the energy transmitted to a portion of the transmitter.

11. The assembly of claim 1, including a coupler positioned in the transmission path between the transducer and the transmitter with the coupler being configured to attenuate the energy transmitted to said lowermost portion.

12. The assembly of claim 11, wherein the coupler is generally elliptical in shape and is configured to produce a pattern of megasonic energy transmission that is other than a radial pattern.

13. An assembly for cleaning a thin flat substrate comprising: a transmitter including an elongated element with a lower edge to be positioned above but closely adjacent to a flat surface of the substrate; a transducer for translating electrical energy into megasonic vibration; and a heat transfer element positioned between the transducer and the transmitter to transmit vibration to the transmitter; wherein the heat transfer element is configured to attenuate the energy transmitted to a portion of the probe.

14. An assembly for cleaning a thin flat substrate comprising: a transmitter having a lower edge to be positioned above but closely adjacent to a flat surface of the substrate; a transducer coupled to the transmitter for translating electrical energy into megasonic vibration; and wherein a face of the transmitter coupled to the transducer is configured to attenuate the energy transmitted to a portion of the transmitter.

15. A megasonic probe assembly for cleaning a thin flat substrate comprising: a probe including an elongated rod with a lower edge along the length of the rod to be positioned above but closely adjacent to a flat surface of the substrate; a transducer for translating electrical energy into megasonic vibration; a heat transfer element positioned between the transducer and a rear end face of the probe; and a coupler positioned between the heat transfer element and the rear end face of the probe, the coupler transmitting the megasonic vibration to the rear end of the probe, the coupler being configured to attenuate the energy transmitted to a portion of said probe.

16. The assembly of claim 15, wherein the coupler is configured to produce a pattern of megasonic energy transmission from the probe other than a radial pattern.

17. The assembly of claim 15, wherein the coupler is generally disc-shaped, but has a portion aligned with the probe lower edge that is configured to minimize the

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transmission of megasonic energy to the lower edge.

18. The assembly of claim 15, wherein a portion of the end face of the probe is spaced from the heat transfer element and the spaced portion is aligned with the probe lower edge so that the transmission of megasonic energy to the probe lower edge is minimized.

19. The assembly of claim 15, wherein the coupler is generally elliptical, and the coupler is configured to produce a pattern of megasonic energy transmission from the probe other than a radial pattern.

20. A megasonic probe assembly for cleaning a substrate comprising: a transmitter having a portion spaced from but closely adjacent to a substantially flat surface of the substrate so that when liquid is applied to the transmitter and the substrate, a meniscus of liquid is formed between the transmitter and the substrate; and a transducer coupled to the transmitter in a manner to create a transmission path so that megasonic vibration from the transducer is transmitted to the transmitter and is transmitted through the meniscus to the substrate as normal-incident waves directly beneath the probe lower edge, and shallow-angle waves on either side of the normal-incident waves, said waves being adapted to loosen particles on the substrate, the transducer being coupled to the transmitter in a manner to reduce a ratio of the normal-incident waves to the shallow-angle waves so as to prevent damage of delicate devices on the substrate beneath said lower edge.

21. A method of cleaning a substrate comprising the steps of: providing a transmitter made of a material that is a good conductor of megasonic energy; positioning the transmitter so that a lower edge is positioned spaced from but closely adjacent to a substantially flat surface of the substrate so that when liquid is applied to the edge and the substrate, a meniscus of liquid is formed between the edge and the substrate; providing a transducer for producing megasonic vibration; coupling the transducer to the transmitter so that a transmission path is created to transmit the megasonic vibration into the transmitter; and creating a barrier in the transmission path so that the liquid vibration is attenuated directly beneath the probe lower edge.

22. The method of claim 21 including the step of creating said barrier by forming a recess in a rear face of the transmitter, with the recess being axially aligned with said transmitter lower edge.

23. The method of claim 21 including positioning a separate element in said transmission path, and said barrier is formed by creating a gap in said separate element.

24. The method of claim 21 including positioning a heat transfer element to form part of said transmission path and configuring the heat transfer element to create said barrier; and conducting heat transfer fluid in heat transfer relation with said heat transfer element to conduct heat away from said transducer.

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L4: Entry 1 of 9 File: PGPB Sep 2, 2004

PGPUB-DOCUMENT-NUMBER: 20040168707
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040168707 A1

TITLE: Apparatus and methods for reducing damage to substrates during megasonic cleaning processes

PUBLICATION-DATE: September 2, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	
Olesen, Michael B.	Yorba Linda	CA	US	
Wu, Yi	Irvine	CA	US	

APPL-NO: 10/ 760596 [PALM]
DATE FILED: January 20, 2004

RELATED-US-APPL-DATA:
Application 10/760596 is a continuation-of US application 09/922509, filed August 3, 2001, US Patent No. 6679272

INT-CL: [07] C25 F 1/00

US-CL-PUBLISHED: 134/001.3; 134/032, 134/033, 134/034, 134/184, 134/137
US-CL-CURRENT: 134/1.3; 134/137, 134/184, 134/32, 134/33, 134/34

REPRESENTATIVE-FIGURES: 7

ABSTRACT:

The present invention provides a megasonic cleaning apparatus configured to provide effective cleaning of a substrate without causing damage to the substrate. The apparatus includes a probe having one of a variety of cross-sections configured to decrease the ratio of normal-incident waves to shallow-angle waves. One such cross-section includes a channel running along a portion of the lower edge of the probe. Another cross-section includes a narrow lower edge of the probe. Another cross-section is elliptical. Another cross-section includes transverse bores originating in the lower edge of the probe. As an alternative to, or in addition to, providing a probe having a cross-section other than circular, the present invention may also provide a probe having a roughened lower surface.

RELATED APPLICATION

[0001] This application is a continuation of copending application Ser. No. 09/922,509, filed on Aug. 3, 2001, the entire contents of which are hereby

expressly incorporated by reference.

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L4: Entry 1 of 9 File: PGPB Sep 2, 2004

PGPUB-DOCUMENT-NUMBER: 20040168707
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040168707 A1

TITLE: Apparatus and methods for reducing damage to substrates during megasonic cleaning processes

PUBLICATION-DATE: September 2, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bran, Mario E.	Garden Grove	CA	US	
Olesen, Michael B.	Yorba Linda	CA	US	
Wu, Yi	Irvine	CA	US	

US-CL-CURRENT: 134/1.3; 134/137, 134/184, 134/32, 134/33, 134/34

CLAIMS:

What is claimed is:

1. An assembly for cleaning a thin, flat substrate, the assembly comprising: a support for engaging a thin, flat substrate, the substrate having at least a first surface; a liquid engaging the first surface; at least a first source of sonic energy; and at least a first sonic energy transmitter spaced from the substrate but in contact with the liquid; wherein the first source applies sonic energy to the transmitter, and the transmitter transmits the sonic energy to the substrate first surface through the liquid, and the transmitter attenuates the sonic energy to reduce the number of sonic waves that strike the substrate at or near a ninety-degree angle.

2. The assembly of claim 1, wherein the support engages a periphery of the substrate.

3. The assembly of claim 1, wherein the support supports the substrate in a substantially horizontal orientation.

4. The assembly of claim 1, wherein the support is rotatable.

5. The assembly of claim 1, further comprising a first source of liquid, wherein the first source of liquid applies the liquid to the substrate first surface.

6. The assembly of claim 1, wherein the first source of liquid is a sprayer.

7. The assembly of claim 1, wherein the first source of sonic energy comprises a transducer.

8. The assembly of claim 7, wherein the transducer is coupled to the transmitter.

9. The assembly of claim 1, wherein the first sonic energy transmitter comprises an elongate probe.

10. The assembly of claim 9, wherein the probe extends generally parallel to the substrate first surface.

11. The assembly of claim 9, wherein a portion of the probe directly adjacent to the substrate is configured to reduce a ratio of normal-incident waves to shallow angle waves.

12. The assembly of claim 9, wherein a portion of the probe directly adjacent the substrate first surface includes a substantially elliptical cross-section.

13. The assembly of claim 9, wherein a portion of the probe directly adjacent the substrate first surface includes an elongate channel.

14. The assembly of claim 9, wherein a portion of the probe includes elongate cutouts that create a narrow edge of the probe, the edge lying directly adjacent the substrate first surface.

15. The assembly of claim 9, wherein a portion of the probe directly adjacent the substrate first surface includes a roughened surface.

16. The assembly of claim 9, wherein a portion of the probe directly adjacent the substrate first surface includes a plurality of bores.

17. An apparatus for cleaning a thin, flat substrate, the apparatus comprising: a support supporting the substrate in a generally horizontal orientation; means for applying a thin film of liquid to a first surface of the substrate; and a sonic energy transmitter; wherein the transmitter transmits sonic energy to the substrate first surface, and the transmitter attenuates the sonic energy to reduce the number of sonic waves that strike the substrate at or near a ninety-degree angle.

18. The apparatus of claim 17, wherein the transmitter transmits sonic energy to the substrate first surface through the liquid.

19. The apparatus of claim 17, wherein the substrate first surface is a top surface.

20. The apparatus of claim 17, wherein the substrate is a semiconductor wafer.

21. The assembly of claim 17, wherein the support is rotatable.

22. The apparatus of claim 17, wherein the means for applying a thin film of liquid comprises a sprayer.

23. The apparatus of claim 17, wherein the sonic energy transmitter comprises an elongate probe.

24. The apparatus of claim 17, wherein the transmitter is formed of quartz, sapphire, silicon carbide, silicon nitride, quartz coated with silicon carbide or quartz coated with vitreous carbon.

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25. The apparatus of claim 17, further comprising a source of sonic energy coupled to the transmitter.

26. The apparatus of claim 25, wherein the source of sonic energy is a transducer.

27. Apparatus for cleaning a thin article having at least a first substantially planar surface, the apparatus comprising: a support for the article; a source of fluid for applying fluid to the first surface; a transmitter configured to vibrate so as to transmit sonic energy through the fluid to the first surface to loosen particles on the first surface; a transducer for vibrating the transmitter; and a wall with an opening therein through which gas is introduced to flow in contact with the transducer; wherein the transmitter attenuates the sonic energy to reduce the number of sonic waves that strike the article at or near a ninety-degree angle.

28. The apparatus of claim 27, wherein the article is supported in a substantially horizontal orientation.

29. The apparatus of claim 27, wherein the article comprises a semiconductor wafer.

30. The apparatus of claim 27, wherein the source of fluid comprises a sprayer.

31. The apparatus of claim 27, wherein the wall forms a part of an enclosure, and the enclosure creates a space surrounding the transducer, and the opening introduces gas into the space.

32. The apparatus of claim 31, wherein the gas purges the space.

33. The apparatus of claim 3.1, wherein the gas cools the transducer.

34. A method of cleaning a thin, flat substrate, the method comprising the steps of: supporting a thin, flat substrate, the substrate having at least a first surface; applying a liquid to the first surface; providing at least a first source of sonic energy; providing at least a first sonic energy transmitter spaced from the substrate but in contact with the liquid; energizing the first source of sonic energy, thereby applying sonic energy to the transmitter; transmitting sonic energy through the transmitter to the substrate first surface through the liquid; and attenuating the sonic energy to reduce the number of sonic waves that strike the substrate at or near a ninety-degree angle.

35. The method of claim 34, further comprising the step of supporting the substrate in a substantially horizontal orientation.

36. The method of claim 34, further comprising the step of rotating the substrate as the liquid and sonic energy are applied to the substrate first surface.

37. The method of claim 34, further comprising the step of spraying the liquid onto the substrate first surface.

38. The method of claim 34, further comprising the step of reducing a ratio of normal-incident waves to shallow angle waves.

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Application#	Patent#	Status	Date Filed	Title	Inventor Name 51
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60304920	Not Issued	159	07/11/2001	MEGASONIC CLEANER AND DRYER SYSTEM	BRAN, MARIO E.
60297736	Not Issued	159	06/12/2001	MEGASONIC CLEANER AND DRYER SYSTEM	BRAN, MARIO E.
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